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WHITEFLIES (*HEMIPTERA: ALEYRODIDAE*) OF ECONOMIC IMPORTANCE AND THEIR NATURAL ENEMIES (*HYMENOPTERA: APHELINIDAE, SIGNIPHORIDAE*) IN ARGENTINA

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ABSTRACT

This paper presents the results obtained from the survey studies conducted since 1993 until now on the host plants/whiteflies/natural enemies associations in Argentina. The whiteflies found were: *Bemisia tabaci* (Gennadius)-complex, *Trialeurodes vaporariorum* (Westwood), *Siphoninus phillyreae* (Haliday), *Aleurotrhixus floccosus* (Maskell), *Aleurotrhixus aepim* (Goeldi), *Dialeurodes citri* (Ashmead).
The greenhouse whitefly *Trialeurodes vaporariorum* and the *B. tabaci*-complex were the most frequent species. The first was observed, as a new record, on *Zinnia* sp., *Coleus blumes* and flax.
The *B. tabaci* complex was found in Buenos Aires province, a locality further south it original distribution, but not on new host plants. The "ash whitefly" *Siphoninus phillyreae*, recently cited for Argentina also was first recorded on *Cotoneaster* sp. in the province of Mendoza.
The following parasitoids were recorded: Aphelinidae: *Encarsia formosa* Gahan, *Encarsia lycopersici* De Santis, *Encarsia porteri* (Mercet), *Encarsia protransvena* Viggiani, *Encarsia transvena* (Timberlake), *Encarsia pergandiella* Howard group, *Encarsia hispida* De Santis, *Encarsia* sp, *Eretmocerus corni* Haldeman, *Eretmocerus* sp., *Cales noacki* Howard; and the hyperparasitoids of the family Signiphoridae: *Signiphora aleyrodis* Ashmead, and Signiphora sp. The species *S. aleyrodis, Encarsia protransvena* and *E. transvena*. represent new records for Argentina.
Key words: whiteflies, host plants, natural enemies.

RESUMEN

Este trabajo presenta los resultados obtenidos de un relevamiento de las asociaciones plantas hospederas/ moscas blancas/enemigos naturales, en Argentina, desde el año 1993 hasta el presente. Las moscas blancas encontradas fueron: complejo *Bemisia tabaci* (Gennadius), *Trialeurodes vaporariorum* (Westwood), *Siphoninus phillyreae* (Haliday), *Aleurotrhixus floccosus* (Maskell), *Aleurotrhixus aepim* (Goeldi) y *Dialeurodes citri* (Ashmead).
Las especies más frecuentes fueron: la "mosca blanca de los invernaderos" *T. vaporariorum* y el complejo *B. tabaci*. La primera fue encontrada en hospederas no citadas con anterioridad, como: *Zinnia* sp., *Coleus blumes* y lino. La "mosca blanca de los fresnos" *Siphoninus phillyreae*, citada recientemente para la Argentina (Viscarret y Botto, 1997) fue encontrada en la provincia de Mendoza en una hospedera no citada anteriormente: *Cotoneaster* sp. *Dialeurodes citri* se cita por primera vez en este trabajo para la Argentina.
Los parasitoides encontrados fueron: Aphelinidae: *Encarsia formosa* Gahan, *Encarsia lycopersici* De Santis, *Encarsia porteri* (Mercet), *Encarsia protransvena* Viggiani, *Encarsia transvena* (Timberlake), grupo *Encarsia pergandiella* Howard *Encarsia hispida* De Santis, *Encarsia* sp., *Eretmocerus corni* Haldeman, *Eretmocerus* sp., *Cales noacki* Howard; y los hiperparasitoides de la familia Signiphoridae: *Signiphora aleyrodis* Ashmead, y *Signiphora* sp. *Signiphora aleyrodis, Encarsia protransvena* y *Encarsia transvena* no han sido citadas anterioriormente para la Argentina.
Palabras clave: moscas blancas, plantas hospederas, enemigos naturales.

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INTRODUCTION

Several whiteflies (Hemiptera: Aleyrodidae) are serious pests on a variety of ornamentals, cotton, soybean, citrus, and other crops, both in the greenhouse and the field (Butler *et al.*, 1983; Coudriet *et al.*, 1985; Bethke *et al.*, 1991). Whitefly damage to crops reduces primarily plant vigor and foliage production. The amount of honeydew that nymphs produce facilitates the establishment of opportunistic fungi on the host plant reducing the photosynthetic area of the leaves (Byrne and Bellows, 1991). On ornamental crops, the fungi reduces the aesthetic quality which causes reduced marketability. Also, many whiteflies are vectors viruses that are very harmful to host plants (Dodds *et al.*, 1984; Duffus *et al.*, 1986; Fishpool and Burban, 1994).

In Argentina, whiteflies have been poorly studied. Most research have covered taxonomical (Tapia, 1970) and/or bioecological (Peterlin and Helman, 1994a, 1994b) studies. In 1993, a biological control project on the greenhouse whitefly *Trialeurodes vaporariorum* (Westwood) was started at Instituto de Microbiología y Zoología Agrícola (IMYZA), Instituto Nacional de Tecnología Agropecuaria (INTA) Castelar. Soon after, in 1994, a Specific Cooperative Agreement between INTA and the USDA (United States Department of Agriculture) was reached to study the natural enemies of the sweetpotato whitefly *Bemisia tabaci* (Gennadius)-complex in Argentina (Botto *et al.*, 1994)

Until now, in Argentina, the information produced on whiteflies and their natural enemies refers mainly to the most conspicuous species, *T. vaporariorum* and *B. tabaci* on crops such as cotton, soybean and vegetables (López and Botto, 1995, 1997; Viscarret and Botto, 1996).

The objective of this research is to present a list of the host plant/whitefly/natural enemy associations recorded from 1993 until now. This study will provide information for the development of biological control and/or IPM strategies for whiteflies in Argentina.

MATERIAL AND METHODS

The whiteflies determined in this study were obtained during a survey initiated in 1993 and include the work started a year earlier in Castelar. The list also includes material from samples sent by collaborators and colleagues from different locations. Samples of inmature and adult whiteflies were collected on cultivated and non-cultivated crops from different agroecological areas in Argentina (Fig. 1).

The following data were recorded for each sample: 1. locality; 2. host plant; 3. treatments (e. g. pesticide use); 4. greenhouse or field production; 5. date; 6. collector and any other data considered important.

The "pupae" and "pupal" cases of the whiteflies collected without signs of parasitism were used for identification. This material was cleared with chlorolactophenol and mounted in modified Faure's solution on a glass microscope slide.

Observations were made under a light compound microscope, and in same cases (*Bemisia* spp.) with a scanning electron microscope (SEM).

The "pupae" of the whiteflies which presented signs of parasitism were placed individually in a glass tube with a trace of honey until the emergence of the adult parasitoids, which were stored in 70% alcohol for identification. Voucher specimens were kept at the collection of the Insectario de Investigaciones para Lucha Biológica, IMYZA, INTA Castelar (whiteflies and parasitoids) and in the collections of the Department of Entomology, The Natural History Museum, London, U. K. (BMNH).

RESULTS AND DISCUSSION

Whiteflies and natural enemies recorded during the survey are listed in the Table 1.

The most commom species of whiteflies observed, regarding their wide host range that they attack and their frequency in the samples were *T. vaporariorum* and the *B. tabaci*-complex.

T. vaporariorum was recorded on *Zinnia* sp. (Asteraceae), *Coleus blumes* Benth (Lamiaceae) and flax. These are new records for Argentina, which also do not appear as host plants in the whitefly catalogue of the world (Mound and Halsey, 1978; Greathead, 1986; Vázquez and Jiménez, 1995; Vázquez *et al.*, 1997; Carver and Reid, 1996). The *Bemisia tabaci*-complex was mainly recorded in the Northwestern region of the country, on cotton, soybean, and *Ipomoea* sp.

Figure 1: Survey areas in Argentina; **A**: Province of Buenos Aires (Sites: Balcarce; San Pedro; neraby Buenos Aires City: Castelar, Gorina, Hurlingham, Ituzaingo; and nearby La Plata City: Colonia Urquiza, Los Hornos, El Peligro, UEEA Gran Buenos Aires, Villa Elisa). **B**: Province of Corrientes (Sites: Bella Vista; Colonia Urquiza/Goya). **C**: Province of Entre Ríos (Site: EEA Paraná). **D**: Province of Formosa (Site: Formosa City). **E**: Province of Mendoza (Sites: Luján de Cuyo; Mendoza City). **F**: Province of Santiago del Estero (Sites: INTA La María; Santiago del Estero City). **G**: Province of Tucumán (Sites: Los Ralos; Los Reales; Cañete)

During this study the presence of *B. tabaci*-complex for Argentina was not only confirmed but also new records were added to its geographical distribution (e.g., the Buenos Aires province).

Dialeurodes citri Ashmead is a new record for Argentina.

The following whitefly parasitoids are new records for Argentina: *Encarsia protransvena* Viggiani and *Encarsia transvena* (Timberlake) (Aphelinidae). These species have a virtually cosmopolitan distribution (Polaszek *et al.*, 1992). Also *Signiphora aleyrodis* Ashmead (probably an hyperparasitoid)(Signiphoridae) is a new record for Argentina. The remaining parasitoid species in Table 1 were recorded by De Santis (1967). Other known whitefly natural enemies previously recorded from Argentina, but not encountered during the present surveys are *Amitus spiniferus* Bréthes, *Encarsia citrella* (Howard), *E. desantisi* Viggiani (as *E. bicolor* De Santis), *E. gallardoi* Marelli, *E. lopezi* Blanchard, *E. nigricephala* Dozier, *Eretmocerus paulistus* Hempel and *Neopomphale aleurothrixi* (Dozier) (De Santis, 1967, 1989; De Santis and Fidalgo, 1994). De Santis (1967) also recorded several *Signiphora* species in association with Aleyrodidae. Since the species-level taxonomy of that genus needs attention, these records require confirmation.

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REFERENCIAS

Bethke, J. A., Paine, T. D. & G. S. Nuessly. 1991. Comparative biology, morphometrics and development of two populations of *Bemisia tabaci* (Homoptera: Aleyrodidae) on cotton and poinsettia. Annals of the Entomological Society of America *84*: 407-411.

Botto, E. N.; Viscarret, M. M. y S. N. Lopez. 1994. Informe anual, Specific Cooperative Agreement Instituto Nacional de Tecnología Agropecuaria-United Stated Department of Agriculture N° 58-4012-3-F069.

Butler, G. D., Jr.; Henneberry, T. J. & T. E. Clayton. 1983. *Bemisia tabaci* (Homoptera: Aleyrodidae): Development, oviposition, and longevity in relation to temperature. Annals of the Entomological Society of America. *76*: 310-13.

Byrne, N. D. & T. S. Jr. Bellows 1991. Whitefly biology. Annual Review of Entomology *36*: 431-457.

Carber, M. & I.A. Reid. 1996. Aleyrodidade (Hemiptera: Sternorrhyncha) of Australia. Systematic Catalogue, Host Plant Spectra, Distribution, Natural enemies and Biological Control. Div. Entomol. Technical Paper N° 37, CSIRO, Canberra, Australia.

Coudriet, D. L.; Prabhaker, N.; Kishaba, A. N. & D. E. Meyerdirk. 1985. Variation in development rate on different hosts and overwintering of the sweetpotato whitefly, *Bemisia tabaci* (Homoptera: Aleyrodidae). Environmental Entomology *14*: 516-519.

De Santis, L. 1989. Catálogo de los himenópteros calcidoideos de América al sur de los Estados Unidos. Tercer Suplemento. Serie de la Academia Nacional de Agronomía y Veterinaria *13*: 1-154.

De Santis, L. y P. Fidalgo. 1994. Catálogo de los himenópteros calcidoideos (Hymenoptera) al sur de los Estados Unidos. Segundo Suplemento. Acta Entomológica Chilena *15*: 9-90.

Dodds, J. A.; J. E. Lee; S.T. Nameth & F. F. Laemmien. 1984. Aphid and whitefly-transmited cucurbit viruses in Imperial County, California. Phytopathology *74*: 221-225.

Duffus, J. E.; R.C. Larsen & H. Y. Liu. 1986. Lettuce infectious yellows virus-a new type of whitefly-transmitted virus. Phytopathology *76*: 97-100.

Fishpool, L. D. C. & C. Burban. 1994. *Bemisia tabaci*: the whitefly vector of African cassava mosaic geminivirus. Science. *34*: 55-57.

Greathead, A.H. 1986. Host Plants. En: Cock, M.J. W. (ED.), Whiteflies: Their bionomics, pest status and management, Intercept Ltd., Andover, U.K., pp. 13-46.

Lopez, S. N. y E. N. Botto, 1995. Parámetros biológicos del parasitoide *Encarsia formosa* (Gahan) [Hymenoptera: Aphelinidae] en condiciones de laboratorio. Ecología Austral *5*: 105-110.

Lopez, S. N. y E. N. Botto, 1997. Biological parameters of the parasitoid *Eretmocerus* sp. [Hymenoptera: Aphelinidae] in laboratory conditions. Biological Control *9*: 1-5.

Mound, L. A. & S. H. Halsey. 1978. Whitefly of the world. a systematic catalogue of the Aleyrodidae (Homoptera) with host plants and natural enemy data. British Museum (Natural History) & John Wiley & Sons, Chichester. 340 pp.

Muñoz, R. G. y M. C. Beeche. 1995. Antecedentes sobre dos especies de reciente identificación para Chile (Homoptera: Aleyrodidae, Aphididae). Revista Chilena Entomología *22*: 89-91

Peterlin, O. y S. Helman. 1994a. Some aspects of the population dynamics of *Bemisia tabaci* as a cotton pest in Santiago del Estero, NW Argentina. International *Bemisia* Workshop. Shoresh, Israel October 3-7, 1994, 11 pp.

Peterlin, O. y S. Helman. 1994b. Parasitoids of *Bemisia tabaci* in Santiago del Estero cotton, NW Argentina. International *Bemisia* Workshop. Shoresh, Israel October 3-7, 4 pp.

Polaszek, A.; G. A. Evans & F.D. Bennett. 1992. *Encarsia* parasitoids of *Bemisia tabaci* (Hymenoptera: Aphelinidae, Homoptera: Aleyrodidae)-A preliminary guide to identification. Bulletin of Entomological Research *82*: 375-392.

Tapia, E. A. 1970. Estudio preliminar de los Aleirodideos hallados en la Argentina (Homoptera). Actas del IV Congreso Latinoamericano de Zoología *1*: 219-234.

Vázquez, L.L. & R. Jiménez. 1995. Moscas blancas (Homoptera: Aleyrodidae) Detectadas en los principales cultivos agrícolas de Cuba. M.I.P. (Costa Rica) *36*: 18-21.

Vázquez, L.L.; Jiménez, R.; De La Iglesia, M.; Mateo, A. & M. Borges. 1997. Plantas Hospederas de *Bemisia tabaci* (Homoptera: Aleyrodidae) en Cuba. Revista de Biología Tropical, *44* (3)/*45* (1): 143-148 (1996-1997).

Viscarret, M. M. y E. N. Botto. 1996. Descripción e identificación de *Trialeurodes vaporariorum* (Westwood) y *Bemisia tabaci* (Gennadius), (Hemiptera, Homoptera: Aleyrodidae). Revista Chilena de Entomología *23*: 51-58.

Viscarret, M. M. y E. N. Botto. 1997. Presencia de *Siphoninus phillyreae* (Haliday), «la mosca blanca de los fresnos» (Homoptera: Aleyrodidae), en la Argentina. Revista de la Sociedad Entomológica Argentina *56* (1-4): 90.

TABLE 1. WHITEFLIES COLLECTED DURING THIS STUDY, THEIR HOST PLANTS AND PARASITOIDS OBTAINED.

WHITEFLY/LOCALITY	HOST PLANT	PARASITOIDS
Trialeurodes vaporariorum EEA Balcarce, Buenos Aires. July 7, 1996	sunflower. (I)	–
T. vaporariorum EEA Paraná, Entre Ríos. August 14, 1996	soybean. (I)	–
T. vaporariorum Colonia Carolina, Goya, Corrientes. September 5, 1996	*Lycopersicum lycopersici* and squash. (I)	–
T. vaporariorum EEA Balcarce, Buenos Aires. September 24, 1996	*Zinnia* sp.(I)	–
T. vaporariorum El Peligro, La Plata. October 31, 1996	weeds and *Lycopersicum lycopersici.* (I)	–
T. vaporariorum Formosa. October 28, November 1, 1996.	*Solanum melongena.*	–
T. vaporariorum EEA Bella Vista, Corrientes. November 11, 1996	*Lycopersicum lycopersici* ("TOMY") (I)	–
T. vaporariorum Villa Elisa, La Plata. November 11, 1996	*Callistephus chinensis.* (I) and *Sonchus oleraceus.*	–
T. vaporariorum Los Hornos, La Plata November 11, 1996	*Phaseolus vulgaris.* (I)	–
T. vaporariorum Ituzaingó, Buenos Aires. December 4, 1996	*Coleus blumes.* (II)	–
Trialeurodes vaporariorum El Peligro, La Plata. January 28, 1997.	*Lycopersicum lycopersici.* (I)	–
T. vaporariorum San Pedro, Buenos Aires. April 11, 1997	*Lycopersicum lycopersici.*	–
T. vaporariorum EEA Gorina, Buenos Aires. April 23, 1997.	*Lycopersicum lycopersici.* (II)	–
T. vaporariorum EEA Paraná, Entre Ríos. May 30, 1997	*Linum usitatissimum*	–
Trialeurodes sp. EEA Bella Vista, Corrientes. October 17, 1996	*Eucalyptus* sp. and *Lycopersicum lycopersici*(I)	–

WHITEFLY/LOCALITY	HOST PLANT	PARASITOIDS
Siphoninus phillyreae Mendoza City, Mendoza. April 9, 1996	*Crataegus* sp. (V) *Cotoneaster* sp.(V)	_
S. phillyreae Luján de Cuyo, Mendoza. May 23, 1996	*Pyrus* sp. (III)	_
S. phillyreae Mendoza City, Mendoza. December 5, 1996	*Fraxinus excelsior.* (IV)	_
Aleurothrixus floccosus INTA, San Pedro, Buenos Aires. September 17, 1996	citric plants. (I)	_
Aleurothrixus aëpim Hurlingham, Buenos Aires. July 18, 1996	*Solanum bonaeriensis.* (V)	_
Dialeurodes citri INTA San Pedro, Buenos Aires. September 17, 1996	citrics plants	_
Trialeurodes vaporariorum Castelar, Buenos Aires. April 2, 1993	*Lycopersicum lycopersici* . (I)	*Encarsia formosa*
T. vaporariorum Colonia Urquiza, La Plata. May 1, 1994	*Lycopersicum lycopersici.* (I)	*Eretmocerus corni*
T. vaporariorum UEEA Gran Buenos Aires, La Plata. December 12, 1996	*Lycopersicum lycopersici.*	*Eretmocerus corni*
T. vaporariorum Hurlingham, Buenos Aires. December 10, 1997	*Solanum melongena* (I)	*Eretmocerus* sp
T. vaporariorum Arana, La Plata. December 11, 1997.	*Lycopersicum lycopersici* ("CHERRY")(II)	*Eretmocerus* sp.
T. vaporariorum Buenos Aires city. March 1, 1998.	? (V)	*Encarsia lycopersici*
T. vaporariorum INTA Castelar, Buenos Aires. April 1998.	*Nicotiana tabacum* (II)	*Encarsia lycopersici*
Bemisia tabaci-complex Los Reales, Tucumán. March 3-8, 1994	*Ipomoea* sp. (III)	?
B. tabaci-complex INTA La Maria, Santiago del Estero. March 9, 1994	*Gossypium hirsutum* ("Guazuncho") (III)	*Eretmocerus* sp. *Encarsia porteri* *Signiphora* sp.

WHITEFLY/LOCALITY	HOST PLANT	PARASITOIDS
Bemisia tabaci-complex Los Ralos, Tucumán. March 10, 1994	soybean. (III)	*Eretmocerus* sp. *Encarsia porteri* *Signiphora* sp.
Bemisia tabaci-complex Los Ralos, Tucumán. March 30, 1994	soybean. (III)	*Eretmocerus* sp. *Encarsia porteri*
Bemisia tabaci-complex Cañete, Tucumán. February 1995	soybean. (III)	*Encarsia pergandiella* group *Encarsia* sp.
B. tabaci-complex Cañete, Tucumán. February 1995	soybean. (III)	*Encarsia porteri*
B. tabaci-complex INTA La Maria, Santiago del Estero. April 6, 1995	*Gossypium hirsutum.* (III)	*Eretmocerus* sp. *Encarsia transvena*
B. tabaci-complex Santiago del Estero. July 1995	*Gossypium hirsutum* (III)	*Signiphora aleyrodis*
Trialeurodes vaporariorum *Bemisia* sp. Ituzaingó, Buenos Aires. November 12, 1996	*Salvia splendens* (II)	*Encarsia porteri* *Eretmocerus corni*
Siphoninus phillyreae Mendoza City, Mendoza. April 9, 1996	*Fraxinus excelsior.* (IV)	*Encarsia hispida*
Aleurothrixus floccosus Buenos Aires city, Buenos Aires March 15, 1998.	citric plants (V)	*Cales noacki* *Signiphora* sp.
Dialeurodes citri Buenos Aires city, Buenos Aires March 15, 1998	citric plants (V)	*Encarsia protransvena*
D. citri Buenos Aires city, Buenos Aires April 1, 1998	ligustrum (V)	*Encarsia protransvena*

Referencias Tabla 1: Greenhouse with pesticides, II: Greenhouse without pesticides, III: Field crops with pesticides, IV: public woodland, V: particular garden. (-): no parasitoids found, ?: Identification pending.